Minnesota River Basin Total Maximum Daily Load Project for Turbidity

Water Quality/Basins

Introduction

This project addresses turbidity impairments in the Minnesota River Basin. The project area begins near Lac Qui Parle in western Minnesota and ends near the city of Jordan. It includes 18 reaches on the mainstem and lower tributaries, including the Chippewa, Redwood, Cottonwood, Blue Earth, Yellow Medicine, Watonwan, and Le Sueur Rivers as well as Hawk Creek. (Map on page four).

Turbid waters of Minnesota River above the dam at Granite Falls in May 2002.

What is turbidity?

Turbidity of water is caused by suspended and dissolved matter such as clay, silt, organic matter, algae and color. Turbidity limits light penetration and inhibits healthy plant growth on the river bottom. Aquatic organisms may have trouble finding food, gill function may be affected, and elevated amounts of sediment associated with turbidity can cause spawning areas and other habitat to be covered. It is recognized as an indicator of water quality – the greater the turbidity the poorer the water.

Total Maximum Daily Load Background

Under the federal Clean Water Act, states are required to submit a list of impaired waters to the U.S. Environmental Protection Agency (EPA) every two years. Some waters are listed for multiple contaminants. In addition to submitting the list, states must evaluate impaired waters to determine pollutant sources and make reasonable progress toward cleaning up or restoring listed waters. A Total Maximum Daily Load (TMDL) study must be conducted for each pollutant affecting an impaired water. The study identifies all pollutant sources and determines the amount of reduction needed by each source to restore water quality. State agencies, local organizations and other stakeholders work together using water sampling data, computer modeling and public input to develop TMDLs.

Description of Water Body

From its source at Big Stone Lake on the South Dakota border, the Minnesota River flows 335 miles southeast to Mankato and then northeast to join the Mississippi at Fort Snelling. Native prairie and pothole wetlands once covered most of the 16,770-square-mile Basin. Today it is a patchwork of farms sprinkled with areas of urban and industrial development with its outlet in a growing metropolitan area. Pollutants include sediment, bacteria, toxics, and algae-producing nutrients such as nitrogen and phosphorus. Its waters often appear turbid or muddy. Turbidity is caused by high amounts of particulate matter, primarily sediment.

Pollution Sources

Streambanks, bluffs, ravines and uplands are sources of sediment in the Minnesota River. Generally, the contributions vary from these sources by watershed and geography. Sediment may run off from fields or enter through unprotected tile intakes. Drainage systems can contribute to high peak flows that may accelerate bank erosion. Bare soil on cultivated fields can be carried into waterways by wind erosion. Nutrients such as nitrogen and phosphorus in the river come from natural sources, land use practices and point source discharges such as wastewater treatment facilities.

Minnesota Pollution Control Agency • 520 Lafayette Rd. N., St. Paul, MN 55155-4194 • www.pca.state.mn.us
651-296-6300 • 800-657-3864 • TTY 651-282-5332 or 800-657-3864 • Available in alternative formats

Measuring Turbidity

Turbidity can be measured by instruments that record how much light is scattered and absorbed in a water sample. This is recorded in Nephelometric Turbidity Units (NTUs). Light can be scattered by suspended particles and soluble colored compounds. The water quality standard for turbidity in class 2B waters is 25 NTUs. Water clarity, which is different than turbidity, can be measured with a Secchi disk or transparency tube. The latter is used in rivers and streams to obtain a stationary sample not affected by the current. It measures the maximum distance in a water sample through which the disk remains visible. In lakes a Secchi disk is lowered into the water to measure the depth of clarity.

River reaches in TMDL project for turbidity

In the Minnesota River:

- Blue Earth River to Shanaska Creek
- Cottonwood River to Little Cottonwood River
- Swan Lake Outlet to Minneopa Creek
- Eight Mile Creek to Cottonwood River
- Beaver Creek to Birch Coulee
- Shanaska Creek to Rogers Creek
- Rush River to High Island Creek
- Chippewa River to Stoney Run Creek
- Timms Creek to Redwood River

In the Blue Earth River

- LeSueur River to Minnesota River
- Rapidan Dam to LeSueur River

LeSueur River: Maple River to Blue Earth River

Watonwan River: Perch Creek to Blue Earth River

Yellow Medicine River: Spring Creek to Minnesota River

Hawk Creek: Spring Creek to Minnesota River

Chippewa River: Watson Sag to Minnesota River

Redwood River: Ramsey Creek to Minnesota River

Cottonwood River: JD 30 to Minnesota River

Total Suspended Solids

Total suspended solids (TSS) is a quantitative measure of suspended matter in water that is closely associated with turbidity. TSS is the concentration of suspended material in the water as measured by the dry weight of the solids filtered out of a known volume of water. TSS is usually expressed as milligrams per liter. TSS can include sand, silt, clay, plant fibers, algae, and other organic matter.

Sediment often comprises most of the TSS in water. The significance of sediment's impact on the quality of aquatic and riparian systems is well established. Sediment in water causes habitat degradation for fish and other aquatic life, stream channel filling, nutrient deposition and resuspension, and reservoir-filling. The EPA (1998) identifies sediment as the single most widespread cause of impairment of the nation's rivers and streams, lakes, reservoirs, ponds, and estuaries. *(Source: Comparability of Suspended-Sediment Concentration and Total Suspended Solids Data – USGS, 2000)*

Impact on Lake Pepin

The Minnesota River contributes about 80 to 90 percent of the sediment load to the Mississippi River and Lake Pepin. The sediment carries a significant amount of nutrients, particularly, phosphorus. At low flows, the nutrients accelerate algae growth in the lake. At higher flows, the sediment is a major cause of turbidity. The fine particles suspended in the water settle out in the upper portion of the lake and represent a third problem for Lake Pepin – an accelerated in-filling. Core studies have shown that, at current sedimentation rates, the upper portion of Lake Pepin will fill in within 100 years and the lower portion will disappear within 340 years compared with natural rates that would fill the lake in 3,000 to 4,000 years. Once the lake disappears, its function as a protector of downstream water quality will disappear as well.

Reducing Turbidity

Land use practices that reduce the amount of sediment and nutrients entering lakes and streams are necessary to reduce turbidity. Riparian (streambank, lakeshore) buffers, streambank stabilization, water storage, surface tile intake buffers or replacements, and crop residue management, all help reduce sediment transport. On farmland, conservation tillage and increased crop diversity, including pasture, can reduce sediment loss. In cities and developing areas, stormwater management and construction erosion control help prevent sediment runoff. On a basin scale such as this, virtually every best management practice involving all types of land use will be necessary.

Existing Reports

Much research and many reports on the Minnesota River Basin and major watershed already exist. They offer much data and background useful to this TMDL project.

- *Minnesota River Assessment Project*, Minnesota Pollution Control Agency (MPCA), 1994.
- *Working Together: A Plan to Restore the Minnesota River*, Minnesota River Citizens' Advisory Committee, MPCA, 1994.
- *Minnesota River Basin Information Document*, MPCA, 1997.
- *Minnesota River Basin Plan*; MPCA, 2001.
- *State of the Minnesota River*; Minnesota State University, MPCA, Minnesota Department of Agriculture, Metropolitan Council, 2008.
- *Fingerprinting Sources of Sediment in Large Agricultural River Systems*, St. Croix Watershed Research Station: Science Museum of Minnesota, 2010.
- *An Integrated Sediment for the LeSueur River Basin;* National Center for Earth-surface Dynamics, 2011.

Minnesota River websites

- Minnesota River Basin Data Center, Minnesota State University, Mankato: http://mrbdc.mnsu.edu
- Minnesota Pollution Control Agency: http://www.pca.state.mn.us/water/basins/mnriver/index.html
- Coalition for a Clean Minnesota River: www.newulmweb.com/ccmr
- Clean Up the River Environment: http://curemnriver.org
- Friends of the Minnesota River Valley: www.friendsofmnvalley.org
- The Minnesota River Scenic Byway: www.mnrivervalley.com
- Redwood-Cottonwood Rivers Control Area: www.rcrca.com

TMDL Project Timeline

Develop TMDL Work Plan – 2005

Project scoping, convene stakeholder group, convene technical advisory committee, finalize work plan.

TMDL Study – 2006

Submit modeling work plan to contactors, evaluate proposals, present to watershed projects, local partners.

Model Scenarios – 2007-2008

Report results of model, committees determine alternative scenarios, test scenarios with stakeholder group, present information to watershed projects and local partners.

Develop TMDL Report – 2009-2011

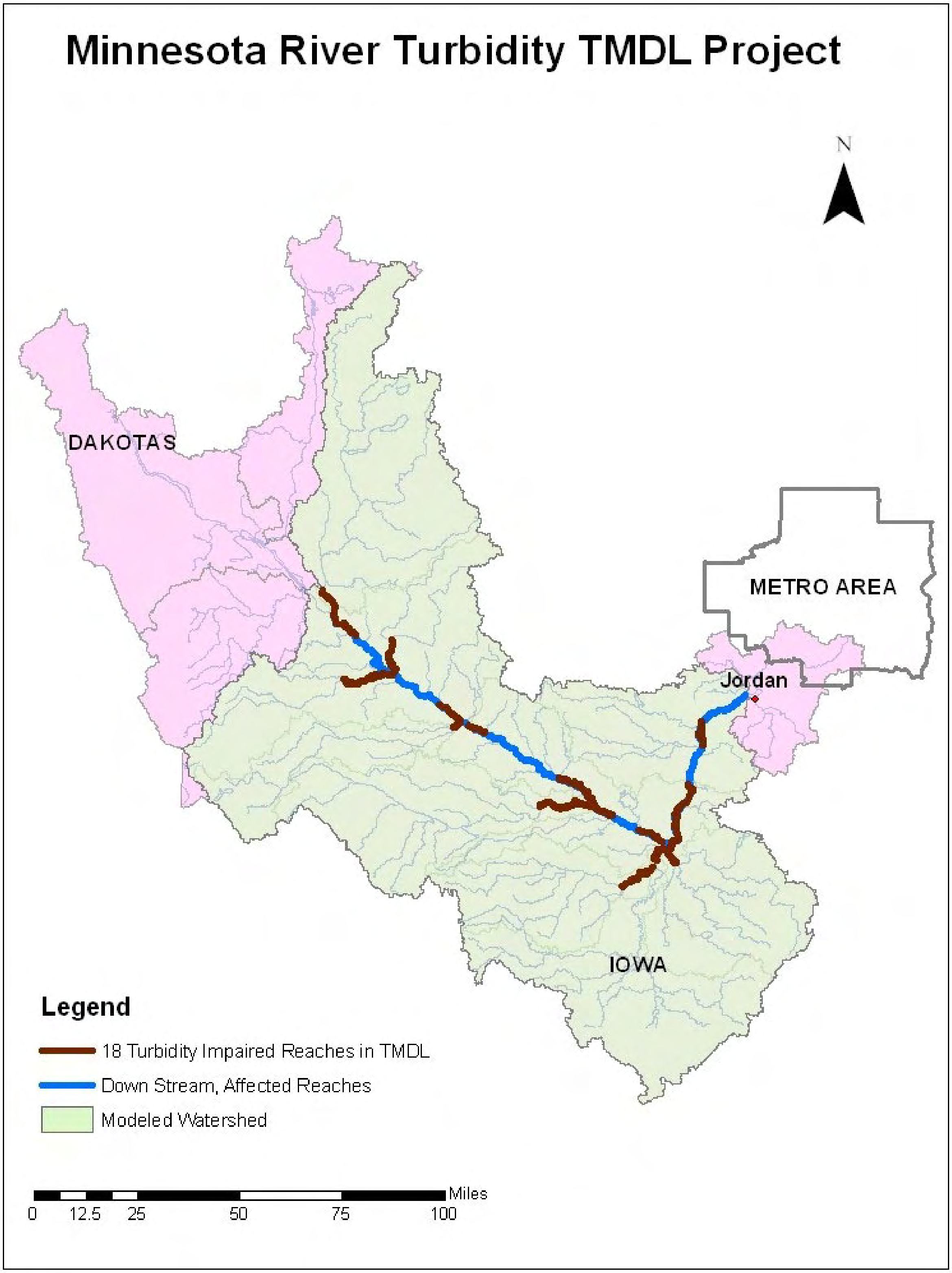
Send draft TMDL report to EPA for review, public comment period, send report to EPA for formal review.

Develop TMDL Implementation Plan – 2012-2013

Work with partners to develop projects.

For more information

For more information about the Minnesota River Basin Turbidity Total Maximum Daily Load project see: http://www.pca.state.mn.us/tchy9c2.


Minnesota River Turbidity TMDL Project
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DAKOTAS
METRO AREA
Jordan
IOWA
Legend
18 Turbidity Impaired Reaches in TMDL
Down Stream, Affected Reaches
Modeled Watershed
Miles
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